



MR. CHARLES R. KNIGHT FINISHING A RESTORATION OF A DINOSAUR

This creature flourished in Wyoming eight million years ago, and is an armored dinosaur, known as *Stegosaurus*

# PREHISTORIC ANIMAL LIFE

By W. D. MATTHEW, Ph. D.

*Curator of the Department of Vertebrate Palæontology, American Museum of Natural History, New York City*

## MENTOR GRAVURES

SMILODON, THE SABER-TOOTHED TIGER • SIBERIAN MAMMOTH • UINATATHERIUM  
EOHIPPIUS, THE ANCESTRAL HORSE • TRACHODON, A DINOSAUR • BRONTOSAURUS,  
A DINOSAUR



THE geologic record of life on earth is divided into three great eras, the Palæozoic or Ancient Life, Mesozoic or Middle Life, and Cenozoic or Recent Life. The Palæozoic begins with the oldest formations that contain any considerable fossil fauna. The Palæozoic era was much longer than the others. An average of various estimates that have been made in recent years would be thirty million years for the whole, of which eighteen million would be the Palæozoic Era, nine million the Mesozoic Era, and three million the Cenozoic Era.

The lower forms of life first appear in our record. During the greater part of the Palæozoic Age the highest types of animals are crustaceans, molluscs, worms and other invertebrates. In the later part appear the first remains of fishes, and towards its end the earliest land vertebrates.



## PREHISTORIC ANIMAL LIFE

It was the Age of Amphibians; and during this time the land vertebrates were gradually emerging from the amphibious stage of their evolution, when they lived in the water and breathed by gills when young, to a dry land existence, breathing air through lungs.

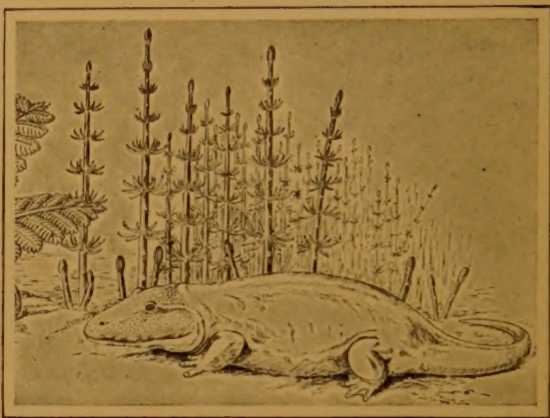
Among these amphibians and primitive reptiles were probably ancestors of the later vertebrates. Others were strange, eccentric looking creatures, races that flourished for a time and died out without leaving descendants.

Such were the Finbacked Reptiles, *Naosaurus* and *Dimetrodon*, with an enormous rigid bony fin upon the back. All of them were clumsy, slow-moving animals, small or large, but none of gigantic size. Their remains have been found chiefly in northern Texas, in South Africa and on the Dwina River in Russia. The great Armored Amphibian *Eryops*, with its large flat head, thick body, short, sprawling legs, webbed feet and eel-like tail, looked like a giant mud-puppy five feet long. It represents very well the stage of evolution among vertebrates when they had abandoned the purely aquatic fish-like existence, and had become partly but not wholly fitted for land and air-breathing existence.

Such then were the animals of the late Palæozoic, or Coal Period—the sluggish, amphibious crawlers from which the land animals of after times evolved. In their later evolution we shall see the dinosaurs, the birds, the mammals evolving upon different plans of adaptation to more efficient and active life.

The dinosaurs are specialized from the first for land life; they develop long, straight limbs and compact feet for walking upon the ground, either upon all fours, or balanced upon the hind limbs. Most of them are large animals; many acquire huge size, and some of them revert partly to a swampy or largely water habitat. The large dinosaurs may, for aught we know to the contrary, have evolved a more perfected and active circulation of blood than modern reptiles, which would enable them to be as active and powerful as their bones would suggest. But it is certain that they had a low type of brain, and in intelligence they were not above the grade of modern crocodiles and lizards.

The birds evolved along a different line. They evolved a warm protecting coat of feathers, which enabled them to maintain a very active circulation and a high and constant body temperature, and, developing wings, they took the air for their province. The aerial life, demanding an intense activity and high intelligence, stimulated the development



Courtesy of Henry Fairfield Osborn

### ANCIENT AMPHIBIAN

The remote ancestors of all higher land animals were of this general type



# PREHISTORIC ANIMAL LIFE

of the brain of birds to a grade much above the reptilian stage. A third province remained of the dominion of the land, the arboreal or tree-life, intermediate in its demands and requirements between the land and air. To this habitat it appears probable that the ancestors of the mammals were at first adapted and for a long time confined. Only after the extinction of the dinosaurs did they come down from the trees and occupy the land. Like the birds, these early mammals developed a warm protective coat, enabling them to maintain a high and constant body temperature; and the higher development of the mammalian brain was probably conditioned by this fact, as well as by the stimulating effect of the active and varied movements required in tree life. The protective coat in mammals was of hair instead of feathers.

A second great feature of progress, enabling them to advance to a higher grade of intelligence and activity, is the increasing care for the young, seen among both birds and mammals, but evolved along different lines. The nesting habits of the bird and the feeding of its helpless newly hatched young, serves the same purpose as the suckling of the young and helpless mammal. In each case it provides the young organism with the time and nourishment necessary to evolve its highly complex organs before it is compelled to apply them in the struggle to maintain an independent existence.

## *The Mesozoic Era or Age of Reptiles*

The Mesozoic Era is divided into periods, as shown in our diagram. The Mesozoic is preëminently the Age of Reptiles. Reptilian life was dominant during the whole of this long era, on land, sea, and even in the air. The reptiles, which had evolved during the previous age from amphibian ancestors, now branched out into a great variety of different races, adapted to different habits and environment. The dinosaurs were chiefly terrestrial, filling the place in nature now taken by the various kinds of higher quadrupeds. Some of them were carnivorous (flesh eating), others herbivorous (herb eating), many of them of gigantic size.

THE LATER AGES OF GEOLOGIC TIME				
Eras	Periods	Epochs	Life Ages	Characteristic Animals
CENOZOIC	Quaternary	Recent Pleistocene	Age of Man	Mammoth. Saber-tooth Tiger
		Pliocene		
	Tertiary	Miocene	Age of Mammals	Uintatherium. Four- toed Horse
		Oligocene		
		Eocene		
		Paleocene		
MESOZOIC	Upper or True Cretaceous		Age of Reptiles	Duck-billed Dinosaurs Horned and Armored Dinosaurs Giant Carnivorous Dinosaurs
	Lower Cretaceous or Comanchic			Iguanodon. Armored Dinosaurs
	Jurassic			Amphibious Dinosaurs Carnivorous Dinosaurs
	Triassic			Primitive Dinosaurs (foot prints, etc.)
PALAEOZOIC (Upper)	Carboni- ferous	Permian	Age of Amphibians	Naosaurus. Dimetrodon Eryops
		Pennsylvanian		
		Mississippian		
	Devonian		Age of Fishes	



---

## PREHISTORIC ANIMAL LIFE

---



ALLOSAURUS—A CARNIVOROUS DINOSAUR

A fierce dominant land animal of the Age of Reptiles, three million years ago

Some walked chiefly upon the hind legs, while others walked upon all fours. Some were covered by a scaly skin, others by heavy, bony armor like a crocodile. The brain case shows that the brain was small and of low type, as it is in all modern reptiles; they were active and powerful, but not intelligent. Such as they were, they had no rivals, for the higher quadrupeds that later populated the earth had not yet arisen.

Other groups of reptiles, adapted to marine life, were dominant in the seas during this era, filling the place now occupied by cetaceans (whales and porpoises) and seals. The Ichthyosaurs were swift swimming reptiles of fish-like form, with the limbs converted into paddles, and a high triangular dorsal fin and forked tail fin, much on the lines of shark or dolphin. The Plesiosaurs were long-necked, with broad body and long paddles like sea-turtles, but no bony shell. The Mosasaurs were another group of marine reptiles, also with paddle-limbs, but proportioned more like the lizards to which they were related.

The most extraordinary of these long extinct races of Reptilia were the Pterodactyls, flying reptiles, with leathery wings like those of bats, but stretched upon a single immensely elongated finger. Most of them were small, but some of gigantic size, twenty-two feet from tip to tip of the extended wings.

Crocodiles and turtles of various kinds were common, and among these too were gigantic marine kinds larger than any now existing. Lizards and snakes also existed during the Age of Reptiles, but very little is known about them. These four orders of reptiles have survived down to the present day, the first two in diminished numbers. The lizards and snakes, on the other hand, seem to have prospered, so that they are now numerous and widespread.

Finally, at the close of the Age of Reptiles, the great majority became extinct. The reasons for this extinction are not clearly seen. The geological record does not seem to support the view that they were



---

# PREHISTORIC ANIMAL LIFE

---

exterminated by the competition of the higher quadrupeds or mammals; rather it suggests that great changes in geography and climate, the drying up of the swamps and disappearing of the shallow seas, and a change from world-wide extension of uniform, moist, tropical conditions to a colder, drier and more zonal climate were in some way connected with their disappearance.

## *The Dinosaurs*

The oldest dinosaurs are found in the Triassic formations of Europe and America. Skeletons have been found in Germany, but in this country they are chiefly known from the innumerable tracks preserved in the slaty sandstones of the Connecticut valley and elsewhere. When first found these tracks were supposed to have been made by gigantic extinct birds, for the three-toed footprint is very like that of a bird. Closer study showed the occasional prints of the fore feet and tail, and here and there the marks of the pelvis and hind limb where the animal sat down to rest. The discovery of dinosaur skeletons in the same formation, with slender limbs and feet that accorded exactly with the impressions, confirmed this explanation. No fossil birds are known until a later period (Jurassic). Some of these footprints (*Brontozoum*) are of large and ponderous animals, but most of them small and slenderly proportioned. The most gigantic of their race were the Amphibious Dinosaurs, that lived about the middle of the Mesozoic, in the Jurassic and Lower Cretaceous periods. These were the largest of four-legged animals, amphibious or aquatic in habits, wading in the streams and bayous of vast coastal marshes and feeding upon the rank vegetation. The best known are the *Brontosaurus* and *Diplodocus*, which reached a length of seventy or eighty feet, and are estimated to have weighed nearly forty tons in life. Even larger than these is the *Brachiosaurus*, distinguished by the great length of fore limbs and neck, through which it could wade to a depth of forty feet without submerging the head. These huge animals are found in all the continents except Australia.

In contrast to the Amphibious Dinosaurs are the Carnivorous Dinosaurs, with large heads, sharp teeth, and sharp, curved, eagle-like claws. These walked or ran upon the hind limbs, using the fore feet to seize and tear their prey. They were active, powerful beasts, with long hind limbs and a long, lizard-like tail, compact body and short neck.



ORNITHOLESTES

An agile little dinosaur restored as seizing one of the primitive birds of the Age of Reptiles



## PREHISTORIC ANIMAL LIFE

Some were of gigantic size, others smaller. They all appear to have been terrestrial, not well adapted for swimming or wading. The *Allosaurus* was a contemporary of *Brontosaurus* and reached a length of thirty-eight feet; while the little *Ornitholestes* was only six feet long. Unlike the Amphibious Dinosaurs, this group survived until the end of the Age of Reptiles, and in the late Cretaceous gave rise to the huge and bulky *Tyrannosaurus*, forty-seven feet in length, as well as to smaller and more slenderly proportioned animals.

Another large group is the *Iguanodonts* or Duck-billed Dinosaurs. These were also more or less bipedal, but otherwise very different from the preceding groups. They were herb eating, with teeth adapted to cutting and grinding vegetable food, a horny beak like a duck, and hoofs upon the feet. Of the last survivor of this race, the *Trachodon* or Duck-bill Dinosaur, many skeletons have been found, occasionally with large proportions of the skin preserved, dried and shrunken like a mummy.

Another group is the Armored Dinosaurs, so called because of the bony plates that cover and protect the body. In one kind, the *Stegosaurus*, the largest plates are set up edgewise in a double row along the back; in others they lie flat, imbedded in the skin as they are in the modern crocodiles. These also were mostly of large or gigantic size, and the latest and largest of them, the *Ankylosaurus*, armor-plated from muzzle to tip of tail, and even the eyes protected by a bony lid, has well been called "the most powerful animated battleship the world has ever seen."

But the most extraordinary of all these extinct giants were the Horned Dinosaurs or Ceratopsians. These

walked on all fours, with limb proportions something between a rhinoceros and an elephant, and a shorter tail than the others. The head is of huge size, bearing long, straight, stout horns. Some kinds have a pair of horns above the eyes three feet in length; others have a horn on the nose like the Indian rhinoceros; and all of them have an enormous bony crest or frill projecting backward and protecting the neck. The feet were round and stubby, like those of elephants, with small hoofs half buried in a thick elastic pad. The jaws, provided with a sharp, hooked, horny, parrot-like beak, and with grinding cheek teeth of curious pattern, show that the animal was of vegetarian habits, and

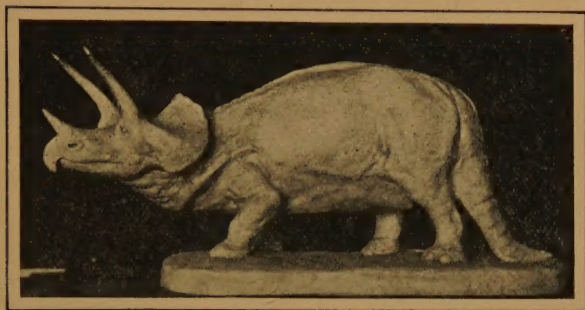


DIPLODOCUS

Enormous dinosaur adapted to take refuge in deep water out of reach of fierce, flesh-eating land animals



# PREHISTORIC ANIMAL LIFE



TRICERATOPS

Great horned dinosaur, equalling a fair sized elephant in size

it probably used the horns for defense against the huge and fierce carnivorous dinosaurs that were its associates.

A strange world indeed it must have been at the time when these dinosaurian giants lived, some millions of years ago. We are apt to think of all these extinct animals as "prehistoric," and to imagine them as associated with

prehistoric man in an antediluvian world peopled with all sorts of grotesque creatures, with whom our skin-clad ancestors had to contend. Such an association is a favorite subject for the cartoonist, but it is far from the truth. In those long vanished days, when dinosaurs still ruled the earth, our remote ancestors were tiny, shrew-like mammals, struggling upward through the slow and difficult stages of their development.

Finally, at or before the close of the Mesozoic Age, most of the reptilian orders disappeared, and the mammals and birds were left to take their place, while the crocodiles, turtles, lizards and snakes survived and continued to play their subordinate rôle throughout the Cenozoic down to the present day.

## *The Cenozoic Era*

The Cenozoic is the era during which the various kinds of mammals were evolved. Only near its close is there any evidence of man as such. It is divided accordingly into the Age of Mammals, or Tertiary Period, and the much shorter Age of Man or Quaternary Period.

The geologic records of the evolution of land animals are far more complete during the Cenozoic than in older periods, especially in the Western States, where the evolution of many races of quadrupeds can be traced through numerous stages of progress in successive geologic formations, from small primitive ancestors, all very much alike, to their widely different specialized modern descendants. Besides these still existing races there are many others that have become extinct.

With the extinction of the dinosaurs a wide field for expansion was thrown open. Coincident with this extinction



BRONTOTHERIUM



## PREHISTORIC ANIMAL LIFE

was a great extension of the areas of dry land, through the drying up of the shallow seas and vast coastal swamps that had extended over great portions of the continents during the later Cretaceous. Undoubtedly there was also a great change during the Tertiary, from the moist, sub-tropical climate that had prevailed in the Cretaceous, to a drier and more zonal condition, cold at the poles, arid in the interior of the continents.

Two groups of animals stood ready to adapt themselves to the new conditions of life, the birds and the mammals. Both were distinguished above their fellows by activity, intelligence, and enterprise; but the long tree experience of the mammals had trained them perhaps to a more flexible, adaptable attitude towards new habits and environment than the more severe but less varied physical training involved in the aerial life of the bird. Whether or not this be the cause, it was the mammals that most readily adopted a purely land life and succeeded best in its various phases. The birds competed with them to some extent and evolved various terrestrial non-flying races, but these were of subordinate importance, except on oceanic islands, where mammals could not arrive save by some rare accident, or in some special environment where they could not so readily maintain themselves. In their own sphere, however, there is reason to believe that the birds expanded during the Cenozoic into the vast variety of races and adaptations that exist today. Unfortunately their fossil record is very defective; fossil birds are few and fragmentary, and we judge chiefly by inference from the structure and affinities of the living forms.



OPOSSUM

Specially interesting as a surviving relative of the Primitive Mammal

### *The Primitive Mammals*

At the beginning of the Tertiary the fossil mammals were all of small size. Their teeth were adapted for insects, fruits, or a varied diet. Their bodies were slender, limbs flexible, feet five-toed, tails long; their brains were small, yet decidedly above the reptilian stage. The majority were of proportions and general appearance much like the modern opossum; these we may suppose were still tree-dwellers. Others had already begun to be adapted to terrestrial life and omnivorous or vegetarian diet, converting claws into hoofs, adapting the feet for walking or running instead of climbing, changing the cheek teeth into a crushing or grinding apparatus and increasing in bulk. The occupation of the new field had already begun, therefore, when the last of the dinosaurs became extinct at the end of the Cretaceous; but it had not progressed far. A few



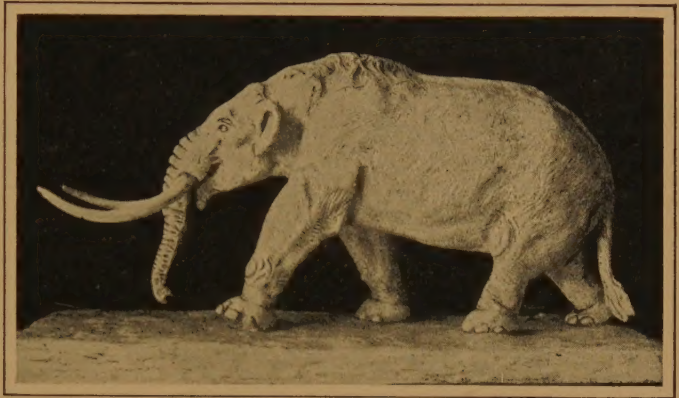
# PREHISTORIC ANIMAL LIFE

conservative races, like the opossum, have persisted almost unchanged to the present day. Certain others, the *primates*, remaining in the trees, continued to perfect their organization for this mode of life, while increasing steadily in brain capacity, and gave rise to the lemurs, monkeys and apes of the present day.

Among the other groups of mammals some retained or reverted to tree life in varying degree; only among the hoofed animals was it altogether lost, and even here there are one or two exceptions.

The terrestrial races evolved into carnivora and various types of herbivora. The carnivora, preying upon other animals, evolved sharp teeth and claws, activity and speed. Some became the ancestors of the modern carnivores, others of races that became extinct. The ancestry of the dogs and cats and of most of the wild carnivora has been traced back to the early Tertiary, where they become so much alike and so confused by the collateral extinct races that they can no longer be distinguished.

Among the hoofed animals we find the ancestors of horses, rhinoceroses and tapirs, animals widely apart today in structure and appearance, so much alike that they are hardly distinguishable, and so different from their modern descendants that the relationship would not be sus-



AMERICAN MASTODON  
Extinct relative of our existing elephant

pected, and was not, until the long series of intermediate stages was discovered in the successive geologic formations of the Tertiary period.

So too with the progenitors of pigs, sheep, cattle and all kinds of ruminants. We find their earliest ancestors, at the beginning of the Eocene, barely recognizable as such by certain peculiarities in the foot bones, but with teeth and skulls in no way distinctive, and only through the succession of intermediate stages



CORYPHODON



## PREHISTORIC ANIMAL LIFE

can we see how they were gradually changed into their modern descendants. About the end of the Eocene we are able to distinguish as such the ancestors of camels and llamas; a little later we can distinguish the beginnings of the deer family, and in the Miocene we meet the first distinguishable antelopes and cattle.

### *Evolution of Elephants*

The earliest known ancestor of the elephant is an animal of quite moderate size, the *Palæomastodon*, with very short trunk and small upper and lower tusks, and a nearly complete set of small, simple cheek teeth, which are very different from the highly specialized grinders of the elephant. In the Miocene we find the mastodons, first the *Trilophodon*, of larger size than *Palæomastodon*, with longer trunk and larger tusks and the cheek teeth becoming fewer in number, but those that remain are larger and more complex. Then follow *Tetralophodon* and *Stegodon* and finally *Elephas*, the trunk progressively longer, the jaw shorter, the lower tusks disappearing, while the upper pair grow into the great curving tusks which we see today lose their enamel completely, and the cheek teeth are reduced finally to one on each side of each jaw; but this is a complex grinder with numerous transverse plates of enamel perpendicular to the wearing surface, and alternated with dentine and "cement."

The direct ancestors of *Palæomastodon* have not been found, but it is no doubt related to a group of primitive Eocene hoofed animals known as Amblypoda. These are traced back to very primitive animals with pig-like teeth, and also gave rise to some very singular extinct types, the *Coryphodon*, with large flaring front teeth and tusks, and the *Uintatherium*, with great saber-like upper tusks, and two or even three pair of bony bosses or "horns" on the top of the skull. Both were large animals, the *Uintatherium* as large as a rhinoceros, and, like the elephant, they have curiously short five-toed feet and straight, post-like limbs, although the skull and teeth do not suggest elephants.

These Amblypoda played an important part in the world in their day. Since the large quadrupeds of modern times had not yet come into existence, the *Coryphodon* and the



ELOTHERIUM



HAIRY RHINOCEROS



---

# PREHISTORIC ANIMAL LIFE

---

*Uintatherium* took their place in nature, and doubtless lorded it over their smaller associates with the same bullying contempt for the rights of the little peoples and heavy confidence in their own strength and size as a modern rhinoceros shows today.

They in turn became extinct, and were succeeded by other massive giants, such as the *Titanotheres*, with a pair of big bony horns above the nose, a distant relative of the rhinoceroses; the *Entelodon* or Giant Pig, a creature with enormous jaws and savage looking teeth; and the *Moropus*, an odd-looking giant, with the neck and head of a horse, a massive body with long fore legs and great claws on the feet instead of hoofs.



ARSINOTHERIUM

Great double-horned beast — remains recently found in the Fayum Desert of Egypt

During the early Tertiary all the southern continents were isolated by ocean barriers, as Australia is today, and in their isolation each one evolved a whole series of animals independently of the northern world. Among these extinct animals the most remarkable in Africa was the great horned *Arsinotheres*, a huge elephantine beast with a pair of long, stout horns. In South America an entirely different set of animals, often resembling the northern animals in one way or another, yet in no wise related, was evolved.

In Australia an equally peculiar set of animals was evolved, representing the various kinds of northern animals, and resembling them often very closely, yet in fact being not even remotely related to northern species, but descended, all of them, from oposum-like animals which had arrived in Australia in the Age of Reptiles. Many of these Australian animals still survive. In Africa and South America very few of their native species now survive; most of them have been supplanted by the northern invaders.

---

## SUPPLEMENTARY READING

### THE AGE OF MAMMALS

By Henry Fairfield Osborn

### HISTORY OF THE LAND MAMMALS OF THE WESTERN HEMISPHERE

By W. B. Scott

### DINOSAURS

By W. D. Matthew

### WATER REPTILES, PAST AND PRESENT

By S. W. Williston

### THE EVOLUTION OF THE HORSE

By W. D. Matthew

### THE EVOLUTION OF THE ELEPHANT

By R. S. Lull

### ANIMAL ROMANCES

By Graham Renshaw

### MORE ANIMAL ROMANCES

By Graham Renshaw

### ANIMALS OF THE PAST

By F. A. Lucas

The following are now out of date, although good in their day:

### EXTINCT MONSTERS AND CREATURES OF OTHER DAYS

By H. N. Hutchinson

### EXTINCT ANIMALS

By Ray Lanbester

\* \* \* Information concerning the above books may be had on application to the Editor



# THE OPEN LETTER

The world is an old, old place. The Solar System, of which it is a small member, is older still; and outside of that is the limitless Universe—and Eternity. The mind exhausts itself in trying to grasp it all. It may be that we were never intended to understand Eternity. Time is for us, and the things of time. We can know and understand some of the things that have happened in the Universe in the course of time—even if the period be millions of years. Such things as are known about the Story of Existence will be told in The Mentor in a clear and simple way by men of recognized authority.

★ ★ ★

In a recent number, Professor Jacoby gave us an account of our planet neighbors. He told us the theories of the origin of the Solar System, according to which large bodies of matter were either flung off from the sun and revolved around it as a center of attraction, or else were set whirling in a vast spiral of which the sun was the hub. Our earth was a small factor in all this great affair, and yet on this little earth was unfolded the greatest mystery of all—Human Life. The Story of Life is a long one—extending back many millions of years. While the earliest records of civilization date back some seven thousand years, Man has existed for at least one hundred thousand years—many high authorities believe that it is even much longer than that.

★ ★ ★

The Story of Life begins with the astronomer. He tells us how our little sphere, playing its part in the Solar System, whirled along and gradually cooled its surface. As it cooled outwardly and labored inwardly, mountain ranges were



FOOTPRINTS OF A DINOSAUR  
Fossil remains found in the red sandstone of  
New Jersey

heaved up, seas were formed and atmosphere was generated. The geologist tells us that part of the story from the records of the earth itself. Then came organic life. By some act of creation—and there a mystery lies—there appeared a jelly-like, semi-fluid substance which was the physical and material basis of life. This the scientists call “protoplasm.” It is made up of two Greek words—*protos*, “first,” and *plasma*, “from.” Protoplasm was the first living material, and out of this substance, scientists tell us, all living organisms developed. Animal life developed first in the water, then on land, and then in the air. In the present number of The Mentor we have from an eminent authority an account of some of the types of animal life as they are to be traced through fossil and other records.

★ ★ ★

The French, always deft in expression, speak of fossils as “documents”—records, that is to say, upon which is chiefly based what we know of the history of life upon the earth. And just as the historian, delving among the documents preserved in museums and libraries, finds there the materials to rewrite or revise the various chapters of human history, so the palæontologist finds in the fossil specimens of natural history museums the evidence for writing the history of the world during the early ages. It is on such evidence that the story in the present Mentor is based.

★ ★ ★

During the latter part of this story Man appeared. In a future number of The Mentor we shall give an account of the beginnings of Humanity, and Prehistoric Man will be considered in text and pictures in a manner similar to that of the present number.

A. S. Moffat  
EDITOR









HAWAII is a territory of the United States of America, and it consists of a chain of islands in the North Pacific Ocean, eight of them inhabited—Hawaii, 4,015 square miles in area; Maui, 728 miles; Oahu, about 600 miles; Kauai, 544 miles; Molokai, 261 miles; Lanai, 135 miles; Niihau, 97 miles; Kahoolawe, 69 miles—and several uninhabited. All these islands are of volcanic origin.

The very early history of the islands is obscure. Credit for their discovery in 1778 is given to the famous navigator, Captain James Cook. He called them the Sandwich Islands, in honor of the Earl of Sandwich, who was First Lord of the Admiralty at the time. The natives made Cook welcome and honored and feared him as a superhuman. The next year, however, he was killed by a savage.

At that time this group of islands was divided into three distinct kingdoms—Hawaii; Oahu and Maui; and Lanai and Molokai. Keona, the chief of the kingdom of Hawaii, died, and his son, Kamehameha I (1736—1819), succeeded him. With the aid of the Europeans he made himself master of all the islands in 1810.

An interesting event of his reign was the manner in which he chose a flag for his kingdom. Of a simple and direct nature, he picked out the national flag that in his estimation was the most beautiful—he chose the Stars and Stripes. England protested against this, and so Kamehameha, eager to please everyone, put, in the place of the stars on the blue field, the crosses of the British emblem. This incident is particularly significant, inasmuch as many years later the flag of the United States of America came really to be the flag of the islands.

At the death of Kamehameha the Great, in 1819, Liloilohi, or Kamehameha II, came into power. He was a well-disposed, but weak, man.

In 1824 the King and the Queen of the Hawaiian Islands paid a visit to England. They both died there of measles, and were succeeded by Kamehameha III, who ruled from 1825 to 1854. He gave the first constitution of the realm to the people in 1840.

In 1842 the independence of the islands was recognized by the United States, and two years later by France and Great Britain. In this same year, John Ricord, an American lawyer, became the first minister of foreign affairs. Kamehameha III and his officers made a new and improved constitution in 1852.

The next king, Kamehameha IV, ruled from 1855 to 1863, and was succeeded by his brother Kamehameha V, who died in 1872. During his reign another constitution—this one reactionary—went into effect. Lunalilo, a grandson of Kamehameha I, was king for two years; and in 1874 Kalakaua was elected to succeed him.

Kalakaua made a trip around the world in 1881, and his sister, Mrs. Lydia Dominis, also called Liliuokalani, acted as regent.

When Kalakaua returned to his kingdom he made up his mind to be the most powerful ruler in the Pacific Ocean. He attempted to annex many of the islands there, and to do this refitted a small steamer as the first man-of-war of the Hawaiian navy. This vessel was named the *Kaimiloa*.

In the meantime, some of the inhabitants of the islands were growing restless. Supporting these insurgents was a voluntary military force, called the "Hawaiian Rifles." On June 30, 1887, a huge mass meeting was held in Honolulu, and this body demanded radical reforms of King Kalakaua. He yielded without a struggle; but throughout the rest of his reign he continually attempted to restore autocratic rule. Kalakaua died on January 20, 1891, in San Francisco, whither he had gone for his health.

On January 29th, his sister, Queen Liliuokalani, took the oath of office. Her reign was a constant effort to restore autocratic government. At last, in 1893, another revolution broke out, and on January 17th the Committee of Safety took possession of the Government Building and issued a proclamation declaring the monarchy to be abrogated, and established a provisional government to exist "until terms of union with the United States of America shall have been negotiated and agreed upon."

This treaty was negotiated with the United States during the next month, just before the close of President Benjamin Harrison's administration. President Cleveland, however, who succeeded him, withdrew it on March 9, 1893.

Then on May 30, 1894, a convention was held to frame a constitution for the republic of Hawaii. This was proclaimed on July 4th, with Sanford B. Dole as its first president. During this same year a plot which was formed to overthrow the republic and to restore the monarchy was frustrated.

When McKinley became president of the United States, in March, 1897, negotiations for annexation were resumed. This new treaty was signed at Washington on June 16th. The treaty was ratified by Congress, and the formal transfer of sovereignty took place on August 12, 1898, when the flag of the United States was raised over the Executive Building in Honolulu with impressive ceremonies.









**H**AWAII, although annexed to the United States in 1898, was not organized as a territory until 1900. The new territorial government was inaugurated at Honolulu on June 14th of that year, and the first territorial legislature began its sessions on February 20, 1901. The legislature, which meets biennially and whose sessions

are limited to sixty days, is composed of two houses: a Senate of fifteen members, holding office for four years, and a House of Representatives of thirty members, holding office for two years. The executive power is vested in a governor, appointed by the President of the United States, and holding office for four years.

Hawaii has a supreme court of three members, five circuit courts, and twenty-nine district courts. In addition to these, there is a United States district court in the territory.

Hawaii is represented in the United States Congress by a delegate, elected by the people of the territory for two years. This delegate may take part in the debates in the House of Representatives, but has no vote.

Education in Hawaii is free and universal. Every child between the ages of six and seventeen must attend either a public school or a duly authorized private school. For this reason the proportion of illiteracy is very low. Naturally, the school system is American in its methods. English is the language used in the schools, although other languages may be taught. There are in the neighborhood of 170 public schools, with close to thirty thousand pupils. There are numerous private schools, with about five thousand pupils.

The most advanced courses of study are offered by Oahu College, which occupies a beautiful site near the beach at the east of Honolulu. It was founded in 1841 and was chartered as Oahu College in 1852.

There are a number of public charities in Hawaii, the principal one being the leper colony on a peninsula almost ten square miles in area, on the north side of the island of Molokai. This place became an asylum for lepers, and the care for them began to be a charity under government charge in 1866. At first conditions were very bad, but they improved later, largely through the self-sacrificing service of the heroic Father Damien. The number of patients, who are almost exclusively native Hawaiians, is slowly but steadily decreasing.

The climate of the Hawaiian Islands is cooler than that of other regions in the same latitude, and it is very healthful. The sky is cloudless to a great extent, and cooling breezes refresh the coast. Some parts of the islands have a very heavy rainfall; others are almost rainless. Or the high mountains snow lies for a great part of the year.

The exports from Hawaii to the United States average annually about \$65,000,000. The imports into Hawaii from the United States average about \$28,000,000. The total value of the imports and exports to all countries for the fiscal year ending June 30, 1916, aggregated \$98,769,062.

The average yield per acre of cane sugar in the Hawaiian Islands is the greatest in the world, thirty to forty tons of cane being the average per acre. Irrigation has extended the cultivation of sugar cane to a very great extent. The sugar farms are mostly on the islands of Hawaii, Oahu and Maui, at the bases of mountains. The annual value of the crop is now placed at about \$55,000,000. Nearly all of this is exported to the United States. Rice is another important crop. It is grown almost entirely by Japanese and Chinese, on small plots along the coast, mostly on the islands of Kauai and Oahu. The yearly value of the crop is somewhere in the neighborhood of three million dollars. Other products of importance are pineapples, coffee, oranges, lemons, figs, tobacco, and some cotton.

The small islands of Lanai and Niihau are devoted chiefly to the raising of sheep and cattle. Niihau is one large privately owned sheep ranch. Cattle raising is second in importance to the sugar industry. There are in the neighborhood of 150,000 cattle and about 100,000 sheep on the islands.

The islands have very little mineral wealth. The manufactures carried on are largely those of sugar, fertilizers, and such machinery as is required for the sugar factories.

There are good wagon roads on the islands, some of them macadamized, being built of the hard blue lava rock. The principal railroad line is that of the Oahu Railway and Land Company, extending from Honolulu west and north along the coast to Kahuku. On the island of Hawaii is the Hilo Railroad, carrying sugar, pineapples, rubber and lumber. There are other short lines of railroad on the islands of Hawaii and Maui.

The position of the Hawaiian Islands is commercially very important. They have a practical monopoly of coaling, watering and victualing in the North Pacific. However, the island group has the disadvantage of having only two safe harbors—that at Honolulu and Pearl Harbor. Hilo Bay on the island of Hawaii is being improved.









THE Hawaiians are an interesting people. They are sometimes called Kanakas, from a Hawaiian word, *kanaka*, meaning "man." These people belong to the Malayo-Polynesian race, and they probably settled in Hawaii in the tenth century. Before that they probably lived in Tahiti and Samoa. The color of their skin

is reddish brown, and their hair is dark brown or black. The Hawaiian face is broad, with large and expressive eyes and a somewhat flattened nose; the lips are thick, and the teeth are excellent in shape and of a pearly whiteness.

The Hawaiians physically are one of the finest races in the Pacific. They are hardy and fairly industrious, and they show considerable intellect. Naturally, in their half-savage state, before the coming of the Europeans, their standard of morals was not high. Since they have become civilized, however, this has changed greatly for the better. Among the rulers polygamy was practised. The Hawaiians were superstitious and practised human sacrifice. These offerings were thought to be especially acceptable to the spirits presiding over the volcanoes of the islands. The people worshiped wooden figures, animals, and the bones of chiefs. Each trade had its special deity; and household gods were also kept. The lower classes expected after death to be slowly devoured by evil spirits, or to live with the gods in burning mountains. The native religion was a mixture of idolatry and hero worship. The king was a war chief, priest and god in one. It is interesting to note that at the death of a king his subjects exhibited extreme license and savagery. This was probably due to the feeling that by the death of a king all law was annulled for the time being.

The Hawaiians were warlike to a certain extent, but there existed some enclosures, called *puuhonuas*, places of refuge, where those that entered were safe under all circumstances. No one would be guilty of violating the sanctity of these places.

The legends of the Hawaiians were preserved in chants; and in the same way such knowledge as they had of botany, medicine and other sciences, was handed down. They had their love songs and dirges. Drums, bamboo flutes and a kind of guitar (the ukelele) were the musical instruments used by the people.

The heart and the liver of the human victims offered in the temple were eaten as a religious rite. Conquering chiefs also ate the same parts of any prominent warrior that was slain in battle against them. They thought that in this way they might inherit the courage of the dead man. Under the system of *taboo*, women were executed if they ate bananas, coconuts, pork or turtles.

The dress of the men consisted of a loin cloth; that of the women was a short

skirt, reaching from the waist to the knee. Now, of course, the men dress in the European fashion; the women wear the *holoka*, a loose white or colored garment with sleeves, reaching from the neck to the feet. On the head is worn either a colored handkerchief or a straw hat. The Hawaiians like to adorn themselves with garlands of flowers called  *leis*, and necklaces of colored seeds.

They are a happy, pleasure-loving race. Their games consist of boxing, wrestling, spear throwing, bowling with stone discs, riding and swimming. We see them in their happiest mood at Waikiki Beach. There they play along the shore like children of Neptune. Of all the spots on the islands, one of the most delightful for the visitor who wants to study the simple, happy people is Waikiki Beach. Surf riding is one of the most exciting of the sports. This is done on surf boards and a so in long, narrow canoes, with outriggers to keep them from turning over. These canoes are paddled some distance out to sea. The boatmen wait for a big roller, then ride gloriously in on its crest.

In much the same way surf boards are ridden by the natives. Some are so expert that they can ride a surf board standing up. This calls for skill and nerve, however. The spectacle of a brown, athletic figure shooting the breakers on a surf board is a fine and inspiring one.

All Hawaiians; men, women and children, are proficient swimmers. It is perhaps because of this that the Hawaiians as a race are noted for their cleanliness.

We hear much of the hula dance, but what is seen of it in its performances in the United States is neither credible nor creditable. The so-called "native performers" are in many cases impostors. The genuine hula dance in Hawaii possessed a good deal of charm. In a modified form it still prevails there.

The national dish of Hawaii is called *poi*. It is made from the root of the *kalo*, which, after having been baked and well beaten on a board with a stone, is made into a paste with water and then allowed to ferment for a few days, when it is ready to be eaten.

The Hawaiian language is soft and harmonious. Every syllable is open, ending in a vowel sound. The only consonants are *k*, *l*, *m*, *n* and *p*, which, with the gently aspirated *h*, the five vowels and the vowel like *w*, make up all the letters in their alphabet. The missionaries first put the Hawaiian language in written form.







**T**HE part of the Hawaiian Islands most familiar to Americans is probably the beach at Waikiki; but the most important part is the city of Honolulu. This city is the capital of the Hawaiian group, and is situated on the island of Oahu, 2,100 miles southwest of San Francisco. In front of the city is a small, well-

protected harbor. Six miles to the west of it is the best harbor in the islands, called Pearl Harbor. These two harbors are the only safe ports in the group of islands.

The harbor at Honolulu was discovered in 1794, and since that time it has been a great place of resort for all sorts of vessels. Traders made it a place to stop from the beginning of the nineteenth century. From 1803 to 1811 Kamehameha I, called the Great, lived in Honolulu. It was in the year 1820 that the city became the chief residence of the Hawaiian sovereign. On January 1, 1909, the island of Oahu and the small islands adjacent came under the name of the city and county of Honolulu.

Throughout the city little poverty and squalor can be found. Good hotels abound, and the residences are attractive. The houses are mostly built of wood. They have broad verandas, and the larger residences possess *lanai*. These are drawing rooms partly built outdoors, with conservatories adjoining.

The buildings of the Government are extensive. The Executive Building was formerly the royal palace. A huge statue of Kamehameha the Great faces the Judiciary Building.

The streets of Honolulu are macadamized with crushed lava. The city has many beautiful parks and squares. The business houses, built of brick or stone, range from two to six stories in height. The schools of the city are excellent. Oahu College, at the east end of the city, was first founded as a school for the children of missionaries in 1841. Among the clubs are the Pacific Club, founded in 1853 as the British Club; the Scottish Thistle Club, founded in 1891, of which Robert Louis Stevenson was a member; the Hawaii Yacht Club, and the Polo, Country and University Clubs.

The population of Honolulu is somewhat over 68,000. The city has several newspapers and periodicals, printed in five languages—English, Hawaiian, Portuguese, Japanese, and Chinese. The chief industries are the manufacture of machinery (especially that used in sugar refineries) and carriages, rice milling and ship-building. The city has an excellent electric street car service, good water works and an electric light plant, the last two of which are owned and operated by the Territorial government.

The business section of Honolulu and the older residence quarters occupy low ground. Many of the newer residences, however, are built on the sides of neighboring hills and mountains. The Punch Bowl, rising behind the city, is a hill about five hundred feet above the sea. The Nuuanu Pali is a high precipice six miles up the valley from the city. It is famous for its view.

Four miles southeast of the city is Diamond Head, a crater about seven hundred and sixty feet in height. At its foot is Waikiki Beach. This beach is famous the world over for its surf riding, boating and bathing.

Everyone who visits Honolulu is fascinated by the climate and scenery. The country round about is a veritable paradise. No other land is more permeated and dominated by perpetual sunshine. It is not a blazing sun that smites to the earth; it is a genial, life-giving, exhilarating sun. And most wonderful of all, this climate lasts the year round. The seasons vary so little that the changes are scarcely perceptible. It is a region of perpetual spring, and life becomes a dream of pleasure. These conditions have naturally attracted large numbers of people to the islands, and many who have come to visit have remained to make their homes there.









LET us make a trip through the Hawaiian Islands. We shall find all of them interesting—some of them more so than others, of course. Let us go first to Hawaii, the island from which the group was named. This island has roughly the shape of a triangle, with sides 90 miles, 75 miles and 65 miles long. Its coast, unlike that of the

other islands of the group, has few coral reefs. Its surface consists mostly of the slopes of five volcanic mountains.

One of the most interesting spots on this island is Kealahou Bay, where Captain James Cook, who discovered the islands, was killed, and where there is a monument to him. When the ship with the white men came to anchor, the natives went out in canoes. At sight of the pale-faced visitors they exclaimed: "At last the prophecy has been fulfilled! Our great god Lono, who departed from us ages ago, has now returned, according to his promise; for he said: 'I will return in after time upon a floating island.'" For this reason Cook was received as a god and worshiped. When, however, one of the sailors died, the natives doubted the immortality of the white men; and finally, after the strangers had violated many sacred things, they were attacked and Cook was killed.

On the eastern shore of Hawaii bluffs rise directly from the sea. Down these bluffs fall beautiful mountain cascades, varying in height from five hundred to a thousand feet.

Hilo, the chief city on the island of Hawaii, is the wettest town in the Hawaiian Islands. There is a saying to the effect that "it is always raining at Hilo"; but as Mark Twain put it, "What if the rain sifts down? The umbrella tree is at hand and the india-rubber tree stands at our very door." Sometimes in Hilo it rains on one side of the street, while the sun is shining brightly on the other. Near Hilo are the famous Rainbow Falls.

The principal products of the island of Hawaii are sugar cane and coffee. Bananas flourish also.

The island of Maui lies about twenty-six miles northwest of Hawaii. It is formed by two mountains, connected by an isthmus. The peaks of these mountains and the valleys of the island are noted for the beauty of their tropical scenery.

From Maui we go to Kahoolawe. This little island is six miles southwest of Maui and is only fourteen miles long and six miles wide. Its mountains are rugged and have very little verdure. The valleys in between afford good pasture ground for sheep.

Seven miles west of Maui is Lanai, another small island, about eighteen miles long and twelve miles wide. It has a

mountain range; and the only water supply on the island is to be found at the bottom of one deep gorge. On the south side of the island rolling table land affords pasturage for sheep.

Sailing a few miles to the northwest, we reach Molokai. This island is about forty miles long, and has an average width of nearly seven miles. On the Kalawao Peninsula on this island is the famous leper settlement. This settlement is separated from the mainland by a rock wall two thousand feet high. This spot can never be recalled without a warm glow of admiration for that noble martyr, Father Damien, the Belgian priest, who, in 1873, voluntarily joined the colony of lepers to help them, and then later contracted the disease and died. Robert Louis Stevenson wrote a glowing tribute to Father Damien, in which he called him "the man who shut with his own hands the door of his own sepulcher." After his death his work was continued by others.

Oahu, the island on which Honolulu is situated, is twenty-three miles northwest of Molokai. It is crossed from southeast to northwest by two nearly parallel ranges of hills, separated by a plain that is twenty miles long and in some parts nine to ten miles wide. The highest point on the island is Mauna Kaala, 4,030 feet, in the Waianae, or western range. The Koolau, or eastern range, is much longer than the other. On the seaward side, it has an almost vertical wall without a break for nearly thirty miles. The valleys are remarkable for their beautiful scenery. The greater part of the coast of the island is surrounded by a coral reef, often half a mile wide.

We next sail sixty-three miles west-northwest of Oahu and reach Kauai, an irregularly circular island, with a maximum diameter of about twenty-five miles. This is called the Garden Island; for no other island of the Hawaiian group is so well watered on all sides by large mountain streams.

Eighteen miles west by south of Kauai is Niihau, the most westerly of the inhabited islands. It is sixteen miles long and six miles wide.

The population of the islands was in 1910 approximately as follows: Hawaii, 55,000; Maui, 28,000; Kahoolawe, 2; Lanai, 130; Molokai, 1,800; Oahu, 82,000; Kauai, 24,000, and Niihau, 200.









PELE was the Hawaiian goddess of volcanoes. With her six sisters and a brother, she was reported to have come from Kahiki (Samoa) in ancient times. These deities lived first at Oahu; then they moved to Molokai; and finally settled on the island of Hawaii. The cone-like craters of the volcanoes were their houses; and when

these craters roared and flamed the goddesses were dancing. The Hawaiians sometimes threw the bodies of relatives into a crater, in order that they might join the company of the deities and afterward befriend the family. Whenever there was an eruption the people would pick *ohele* berries and throw them into the crater as an offering to Pele. They also sacrificed pigs, for pork was supposedly a favorite dish of the gods.

Hawaii Island is volcano land. Mauna Loa (Great Mountain), on the south side of the island, is by far the largest volcano in the world. From a base measuring at sea level about seventy-five miles from north to south and fifty miles from east to west, it rises gradually to a height of 13,675 feet. Kilauea rises to an elevation of 4,000 feet above the sea on the east-southeast side of this mountain. Mauna Loa and Kilauea are still active. Kilauea has the largest active crater in the world, it being eight miles in circumference.

Mauna Kea—called White Mountain from the perennial snow on its summit—rises to the height of 13,823 feet above the sea, the greatest height of any mountain in the Pacific Ocean. Mauna Kea lies to the north-northeast of Mauna Loa. To the north-northwest of Great Mountain is Mauna Hualalai, 8,269 feet in height. The last eruption of this mountain was in 1801.

Mokuaweoweo is the crater crowning the summit of Mauna Loa. Formerly, on the eve of an eruption of Great Mountain this crater spouted forth columns of flame and emitted clouds of vapor; but of late years this action has usually been followed by a fracture of the mountain side from the summit down to a thousand feet or more below, where the lava is discharged in great streams, the action at the summit diminishing or even ceasing when this discharge begins. The first recorded eruption of Mauna Loa was in 1832. Since then there have been about a dozen eruptions. Three of them have been attended by earthquakes; while in 1868 huge sea waves, forty feet in height, were raised, that destroyed several villages.

One of the most terrific of Mauna Loa's eruptions occurred on July 4, 1899. An account of this eruption has been given by one member of a party that visited the mountain while the eruption was still in progress. This party had great difficulty in getting near the crater. At last they came within a thousand feet of an active

cone. "This cone, as near as could be ascertained, was 200 feet high, and the crater at the top was fully 500 feet in diameter. It was, in fact, a veritable volcano, spouting molten, red-hot lava as high as a hundred feet or more above the crater. This lava fell back, building up the sides of the cone very rapidly. At irregular intervals, with a great roar and a boom, large boulders that must have weighed over a ton, shot into the air, away above the glare of the lava, as near as could be estimated, about 400 feet, or nearly twice as high above the rim of the cone as it was above the base."

They remained on the mountain until after dark and witnessed a display of grandeur and power that will never be forgotten.

"It was a gorgeous illumination. The steam and smoke were lit up until the heavens were as bright as day. The long, snake-like flow below became more intense in its glow. The crater itself seemed to realize that it could make a better showing at night, and the fountains of fire were more active, while the great boulders were thrown into the air at more frequent intervals. It was a revel of fire, the very incarnation of the Hawaiian idea of the goddess Pele.

"While we were witnessing the spectacular display of pyrotechnics, the wind had changed, and as the crater on the side nearest us was pouring forth sulphur and gaseous smoke, we found ourselves cut off by the deadly fumes. We could not go around the cone, because it would be impossible to cross the flowing lava. Neither did we know that we were within a mile or two of the Shipman Trail that led to the Volcano House. It seemed as though we were hemmed in and must meet instant death."

At this moment, however, the smoke near them lifted in the form of an arch, and they decided to hazard a run through it. Covering their faces as well as they could, to exclude the smoke and sulphur from their lungs, they made a dash and passed through in safety.

There are forty volcanic peaks in the Hawaiian Islands. On the island of Maui is Mauna Halea'ala, which, rising to a height of 10,032 feet, has at its summit an extinct pit crater which is one of the largest in the world. This crater is about seven and one half miles long, two and one half miles wide, and covers nineteen square miles. Its greatest depth is 2,720 feet.